Attitudinal and normative responses to advertising stimuli and vaping intentions.

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Conflict of interest
The authors declare that there is no conflict of interest.

Abstract
Empirical data to show whether exposure to e-cigarettes advertising stimuli may influence former- and never-smokers to consider vaping is lacking. We examined whether former- and never-smokers' cognitive, affective and normative responses to e-cigarettes stimuli in retail outlets will predict their vaping intention. A repeat cross-sectional study recruited 876 participants aged 18-24 years in waves one and two in the UK. Bayesian structural equation modelling tested mediation and moderation effects of the variables of interest. Results from waves one and two revealed that the effect of salience of e-cigarettes advertising in stores and gas stations on vaping intention was mediated by affect and subjective norms among former smokers. Cognitive attitudes of never smokers mediated the effect of salience of e-cigarettes advertising in retail outlets on vaping intention at waves one and two. Former smokers were more likely to hold stronger affect towards vaping than never smokers at wave two. Our study supports the need for stronger policies to restrict e-cigarettes portrayals in retail outlets, as advertising messages can trigger strong thoughts, feelings, and norms of vaping. Interventions may benefit from including attitudinal and normative components to promote pro-social behaviour.

Keywords: *electronic cigarettes, attitudinal responses, promotional messages, smoking norms, intentions to vape*

Introduction

The increasing popularity of electronic cigarettes (e-cigarettes) as an alternative to regular cigarettes continue to generate much controversy. This is partly because of the mixed evidence of its efficacy and safety as an effective aid for smoking cessation (Majeed et al. 2017; Huang et al. 2016; Bullen et al. 2013). Prior studies have found potential toxicants in e-cigarette liquids and vapor (Glasser et al. 2017). The use of e-cigarettes may also produce mild adverse reactions such as mouth and throat irritation (Caponnetto et al. 2012; Polosa et al. 2014). The WHO Framework Convention on Tobacco Control report suggested that manufacturers and third parties should be prohibited from making health claims that e-cigarettes are smoking cessation aids, until convincing scientific evidence is provided (WHO 2014, 2017). To date, empirical evidence has found no conclusive evidence to support the assertion that e-cigarettes are safe and harmless (Glasser et al. 2017; Polosa et al. 2017; Pisinger & Dossing 2014). Instead, studies suggest that e-cigarettes are a much less harmful alternative to smoking (Polosa et al. 2017; Farsalinos & Polosa 2014; Bullen et al. 2013). However, the extent of residual risk associated with carbonyls such as nicotine, flavours, and other constituents of e-cigarettes remains unclear (Bhatnagar 2016). More so, although e-cigarettes might provide a lower level of risks than traditional cigarettes especially for adult smokers who switch from regular cigarettes to nicotine delivery products (Food and Drug Administration 2018), the degree to which e-cigarette use may result in more benefit than harm at the population level is understudied (Grana, Benowitz & Glantz 2014).

Given the nonlinear dose-response relationship between tobacco exposure and the risk of developing cardiovascular diseases, even exposure to low levels of harmful constituents can have a pronounced effect on vapers (Bhatnagar 2016). Besides, whether e-cigarette use confers a lower risk of addiction compared to regular cigarettes remains a point of controversy. More research is therefore needed to assess its efficacy and safety against other cessation methods. In addition, perceptions of safety and harmfulness of users and non-users may affect their consumption. Presently, little is known about the long-term health effects of e-cigarettes use (Walele et al. 2018). The widespread acceptance of e-cigarettes could renormalize the use of tobacco products and recruit a new generation of users to nicotine addiction. Likewise, electronic cigarettes might encourage the transition to conventional cigarette use among never smoking adolescents and young adults (Primack et al. 2015; Leventhal et al. 2015), though evidence suggests that electronic cigarettes use may help users to quit smoking (Hajek et al. 2019). However, given that electronic cigarette use among young people is increasing, the potential risk associated with vaping is high. For instance, e-cigarettes were the most commonly used tobacco product among high school (11.7%) and middle school students (3.3%) in the US (Wang et al. 2018). In the UK, 7.6% of males compared to 3.1% of females aged 16 to 24 years were current e-cigarettes users (Office for National Statistics 2018), which is a gradual increase from 2014 to 2017.

This increase has taken place in the face of continued long-term declines in smoking prevalence among adults and youth (Office for National Statistics 2018). Although e-cigarette use may encourage reduction and abstinence from regular cigarette smoking, never cigarette smokers who start cigarette smoking through the use of e-cigarettes may become long-term daily cigarette smokers. So electronic cigarettes may offer a new opportunity for smokers who are unable or unwilling to quit, by reducing their chances of getting smoking-related diseases (McRobbie et al. 2014; Bullen et al. 2016), yet it might also lead to renormalisation of smoking. Some researchers have argued that e-cigarettes should be banned for lack of safety and efficacy data. In line with this, some countries such as Australia and Norway have banned e-cigarettes although these are highly visible and available on the internet (Adkison et al. 2013).

As such, smokers in countries with e-cigarettes regulations may still access and purchase these online. The UK government is yet to enact a comprehensive ban on e-cigarettes partly because

of the inconclusive evidence regarding e-cigarettes use. A report by Public Health England suggested that e-cigarettes are not completely risk-free although when compared to tobacco smoking, evidence suggested that they carry a fraction of the harm (Public Health England 2016). Despite the gradual increase in e-cigarette use, there is lack of research on how e-cigarettes advertising might affect former smokers' attitudes and lead to relapse. It is imperative to assess smokers' attitudinal responses to e-cigarettes promotion. The advertising literature describes how favourable attitudinal responses can be triggered by an advertising campaign exposure to affect behavioural outcomes like vaping (Lavidge & Steiner 1961). Exposure to e-cigarettes promotional campaigns may play a role in shaping smokers' beliefs and norms of vaping, howbeit, empirical data to support how promotional stimuli may influence smokers' intentions to vape is lacking (Chan et al. 2018; Popova et al. 2018). Essentially, little is known about how never- and former-smokers' response to e-cigarette messages might shape their attitudes, norms and future intentions to vape. This study examines whether salience of e-cigarette advertising on vaping intentions of never- and former-smokers is mediated by attitudinal responses and normative beliefs.

Electronic cigarettes advertising

E-cigarette advertising has contributed to the surge in popularity and use of e-cigarettes among young people (Vivek et al. 2016; Wagoner et al. 2019; Cantrell et al. 2016). Prior research has found that more than half of retail stores had depictions of e-cigarette advertising (Wan et al. 2017). At the same time, exposure to electronic cigarettes advertising has been associated with an increase in urges to smoke (Kim et al. 2015) and use of e-cigarettes (Auf et al. 2018; Camenga et al. 2018; Pike et al. 2019). A study found that e-cigarette advertisement on television increased e-cigarette demand, which in turn led to cigarette demand (Zheng et al. 2016). Such results undermine efforts to reduce cigarette smoking. Notwithstanding other studies have found that e-cigarette advertising may influence smokers to quit smoking (Dave et al. 2019; Kim et al. 2015), with some studies indicating that e-cigarette advertising does not encourage smoking (Nagelhout et al. 2016; Jo et al. 2018). Indeed, Dave et al.'s (2019) study indicated that banning e-cigarettes television ads would have reduced the proportion of smokers who quit. As such it is still unclear whether e-cigarettes and conventional cigarettes are substitutes or complements. Nonetheless, on the balance of evidence, most studies have found that exposure to televised e-cigarette advertisements can increase awareness significantly among youths and young adults (Farrelly et al. 2015; Marynak et al. 2018; Pike et al. 2019).

More importantly, awareness of e-cigarettes advertising has been associated with an increase in use among young adults and older people (King et al. 2015). In the US, the truth initiative estimated that 84% of young people age 13-21 years are aware of e-cigarette advertising (Truth Initiative 2015). Likewise, a report by the American Legacy Foundation (2014) indicated that around half of young adults were likely to be exposed to televised e-cigarette advertising, print media adverts, and point-of-sale advertising. Indeed, a growing body of evidence suggests a surge in the prevalence of point-of-sale e-cigarettes advertising (Wan et al. 2017; Ganz et al. 2015; Rose et al. 2014). Besides, research has found that exposure to televised youth e-cigarette advertisements increased by 256% between 2011 and 2013 (Duke et al. 2014). Likewise, over the same period, exposure to young adults increased by 321%, which supports research showing that a large proportion of e-cigarette marketing expenditures are focussed on young adults (Kornfield et al. 2014; Durbin et al. 2014). E-cigarette advertising has also been portrayed among youths as healthier (Grana and Ling 2014; Willis et al. 2017), less expensive

than regular cigarettes (Johnson et al. 2017; Richardson et al. 2015) and more socially acceptable (Willis et al. 2017; Klein et al. 2016).

Despite the prevalence of e-cigarette advertising, restrictions on electronic cigarettes advertising are weak in several jurisdictions (Barraza et al. 2017; Department of Health and Social Care 2016). Although some studies on e-cigarette advertising have found positive smoking cessation results, it is too early for the public health community to advocate unrestricted advertising of e-cigarettes. In the US, the Food and Drug Administration has started to regulate e-cigarettes, which includes restrictions on sales to individuals under 18 years of age, health warnings on packages, and bans on free samples and vending-machine sales. The UK has implemented article 20 (5) of the Tobacco Products Directive 2014/40/EU, which requires EU Member States to introduce restrictions on the advertising of electronic cigarettes (Department of Health and Social Care 2016). From that date the advertising or promotion, directly or indirectly, of electronic cigarettes and refill containers on media platforms with cross border impact was prohibited, including on television, radio, newspapers and magazines (Action on Smoking and Health 2019). However, there are currently no restrictions on some forms of e-cigarettes marketing such as outdoor and point-of-sale advertising (Department of Health and Social Care 2016; Action on Smoking and Health 2019). It is not surprising that the tobacco industry has exploited the loopholes in the legislation to increase e-cigarette advertising expenditure substantially (Wan et al. 2017; Duke et al. 2014; Cantrell et al. 2016; Truth Initiative 2015). Notably, studies that have examined awareness of e-cigarette advertising on smoking norms are limited. A study found that youth non-users are able to recall e-cigarette advertising that depicts the products as being a healthy alternative and promises to help smokers quit (Chen et al. 2019; Choi et al. 2012), and associated users with being popular in social settings. Such evidence is worrying because it can affect non-users' decision to vape in the future, especially when they are in a conducive social settings. We examine the mechanisms underlying how awareness of advertising in retail outlets may affect future intentions to smoke.

Attitudinal responses to advertising stimuli

The literature on marketing communication has shown how attitudinal responses can mediate the effect of advertising input on behavioural responses (Lavidge & Steiner 1961; Yang et al. 2018). Advertising itself has been considered as an attitudinal object, and attitudes toward the adverts can determine consumers' responses to the advertising stimuli. Attitude is a multidimensional construct comprising cognitive, affect, and conative components (Krech, Crutchfield & Ballachey 1962; McGuire 1969; Rosenberg & Hovland 1960). The hierarchy of effects model has been used to explain how promotional messages work – that is, how consumers go through a variety of stages, namely cognitive, affect, and conative, in responding to the advertising message (Lavidge & Steiner 1961; Yoo et al. 2004). The cognitive dimension (thinking), is based on developing awareness and knowledge of the ad message. Cognitive therefore refers to 'mental activity' and reflects consumers' knowledge, beliefs or thoughts about the advertising message (Barry & Howard 1990). The affective component (feelings) involves developing emotions, which can be attributed to the ad message or product. The conative dimension (intentions to act) describes the development of conviction or intentions (Lavidge & Steiner 1961) and refers to intention to perform a behaviour such as a purchase intention (Egan 2007).

Several researchers have conceptualised models that support use of the hierarchy of effects framework. Colley (1961) conceptualised DAGMAR (Defining Advertising Goals for

Measured Advertising Results), which supported use of a hierarchy of advertising objectives to measure advertising effectiveness. Likewise, Robertson (1971) proposed an awareness, comprehension, attitude, legitimization, trial, and adoption hierarchy. More so, much of the work of Preston (1982) and Preston and Thorson (1984) followed the hierarchy model. Despite the development of models in support of the hierarchy model, there have been some disagreements among scholars about the order of the three stages of the hierarchy. Krugman (1965) suggested a cognitive-conative-affect sequence. The work of Zajonc (1984) and Zajonc and Markus (1982) suggested that behavioural outcomes do not require a cognitive basis. Instead, they indicated that behavioural outcomes like preferences are mainly based on affective formation. Therefore, one's action can be determined by affect which then leads to affect – behaviour path. The work of Ray et al. (1973) also proposed that a conative-affect–cognitive sequence, means that consumers typically behave first, then form attitudes to reinforce the preference, and subsequently engage in selective learning to support that behaviour. Vaughn (1980) posited the possibility of affect-cognitive-conative sequence, which was mainly related to consumers who responded to emotions more than information in making purchase decisions. As such there are different combinations of the order of hierarchy frameworks, and all the models explain how consumers respond to advertising messages. Our study draws from the traditional hierarchy of effects model (Lavidge & Steiner 1961) and proposes that an individual's decision to start vaping may be concurrently determined by affect and cognitive responses to promotional stimuli. The tobacco literature suggests that people smoke because of careful thought processes (e.g. perceptions of health risks and benefits of smoking), and positive or negative feeling about the object (e-cigarette) or promotional message (Popova et al. 2018). Hence, consumers' decision to start vaping will be simultaneously affected by emotional and cognitive responses to a stimulus. Although studies have examined smoking prevalence and attitude-relevant responses toward e-cigarettes (Popova et al. 2018; Dockrell et al. 2013), there are limited studies on how the three distinct attitudinal variables might be affected by promotional messages. This study expands on the hierarchy model to examine whether former- and never-smokers' cognitive, affect and normative responses to advertising messages might affect their conative attitudes. It is possible that affect will occur with or without conscious awareness. As such we propose that both former- and never-smokers may have different beliefs, thoughts, and emotions about vaping, and may go through the hierarchy differently.

Cognitive and affective responses to advertising message

Exposure to advertising stimulus may lead to a cognitive response, which involves elements of memory, knowledge structure, beliefs, and thoughts (Bettman & Park 1980; Popova et al. 2018; Yang et al. 2018) as well as sensory elements of imagery and its associations (Holbrook & Hirschman 1982). During exposure to the ad message, cognitive concepts can be activated that are congruent with the triggered affective reactions. This process, known as affective priming, can affect cognitive reactions to the ad, especially thoughts about arguments. Likewise, affect can be used as a basis for judgement as consumers infer their cognitive attitude toward the advertised brand from the feelings they experience based on heuristic experience (Forgas 1995). Once cognitive responses of potential users (e.g., former smokers) are triggered, this may reflect favourable or unfavourable evaluations of the attitude object, i.e. the stimulus (Fishbein & Ajzen 1975; Yang et al. 2018). In this regard, marketing messages that promote the health benefits of e-cigarettes may create favourable cognitive responses among consumers (Rüther et al. 2015). Such favourable attitudinal responses to marketing stimuli (e.g. knowledge

of electronic cigarettes as a healthier choice) may encourage positive thoughts about vaping. In the same vein, never-smokers who are exposed to marketing stimuli promoting the health benefits of e-cigarettes may develop positive cognitive attitudes and think favourably about vaping in the future. Thus, one's cognitive responses may affect their conative response (i.e. intentions to vape), which is the most proximate to actual behaviour. Based on the foregoing literature, we propose that:

H1—Salience of e-cigarette advertising messages will predict cognitive responses of former- and never-smokers.
H2— Favourable cognitive responses will predict intention to vape among former- and never-smokers.

Affective response has been described as mood or feelings evoked by marketing stimuli (Batra & Ray 1986; Popova et al. 2018). For instance, former smokers may hold affective responses toward an attitude object such as ad promoting e-cigarettes. Such an advertising message and its creative execution can trigger affective responses among the target group (e.g. former smokers) when they are exposed to the ad. Here, consumers may have favourable or unfavourable feelings towards e-cigarettes or e-cigarette promotional stimuli. Those who may feel good about e-cigarettes use e.g., because of the benefits it offers would appear to hold positive emotions and may think favourably about vaping in the future. Alternatively, those who may hold unfavourable feelings about e-cigarettes use perhaps because of beliefs that vaping is equally harmful like smoking may develop negative emotions toward the object (Dockrell et al. 2013; Yang et al. 2018), and not consider vaping in the future. So, one's affective response towards an attitudinal object may influence their conative responses – considerations about intentions to vape. Former smokers with positive affective responses toward e-cigarettes messages may express intentions to use e-cigarettes in the future and may encourage their peers to vape. Non-vapers (e.g. never-smokers) with favourable attitudes toward electronic cigarettes messages may also express future smoking intentions, which might lead to renormalisation of smoking. Based on the literature above, we hypothesise that:

H3—Salience of e-cigarette advertising stimuli will predict affective (emotional) responses of former- and never-smokers.
H4—Favourable affective (emotional) responses will predict intention to vape among former- and never-smokers.

Normative responses to advertising messages
Aside from the multidimensionality of attitudes, evidence suggests that normative beliefs can shape an individual's behavioural intentions and actions (Schultz et al. 2008; Cialdini et al. 2006; Murdock & Rajagopal 2016). The theory of reasoned action posits that behavioural outcome is affected by behavioural intentions, which are also affected by subjective norms and attitudes toward the behaviour (Fishbein &Ajzen 1975). Research shows that subjective norms, which are a function of beliefs about important referents and motivation to act in accordance with those referents (Finlay et al. 1997), can guide behaviour. Subjective norms can be strengthened if the perceived expectation of important referents is stronger and vice versa. For example, if the expectation of friends to vape is stronger, then the subjective norm to vape is likely to be stronger. Past studies have found a pathway between subjective norms and behavioural intentions (Chang 1998; Vallerand et al. 1992; Phua 2019). It is possible that exposure to promotional stimuli can trigger subjective norms and positively affect intentions to vape. Knowledge of how advertising stimuli can activate subjective norms and consequently affect considerations to vape is limited. We expect subjective norms to be triggered by

promotional messages, and to influence intentions to vape among former smokers and never smokers. Hence, we propose that:

H5—Salience of e-cigarettes advertising messages will predict subjective norms of former- and never-smokers.
H6— Stronger subjective norms will predict intentions to vape among former- and never-smokers.

Our study contributes to knowledge by drawing from the hierarchy of effects model (Lavidge & Steiner 1961) and theory of reasoned action (Fishbein & Ajzen 1975) to examine attitudinal and normative responses to e-cigarettes promotional stimuli, and whether these responses will predict future intentions to vape. To the extent that non-vapers' attitudes and normative beliefs about vaping may be triggered by exposure to e-cigarettes advertising messages, our study aims to provide a better understanding of the underlying reactions to e-cigarettes messages and unravel the characteristics of potential e-cigarette users. We propose that subjective norms will independently interact with cognitive and affective responses to predict intentions to vape. We therefore propose that:

H7—Subjective norms will interact with cognitive attitudes to predict intention to vape among former- and never-smokers.

H8—Subjective norms will interact with affect to predict intention to vape among former- and never-smokers.

Insert figure 1 here

Methods

Sampling procedure

A repeat cross-sectional survey was used to recruit participants via a convenience sampling technique from the UK adult population. The aim was to recruit non-vapers who were either former smokers or never smokers to examine their tendency of vaping or using e-cigarettes in the future. The inclusion criteria only permitted participants aged 18 to 24 years as it is important to understand whether youths who progress to adulthood will continue or start vaping. In addition, this age bracket is a critical transition period which presents young adults with more opportunities to engage in or continue previously discouraged behaviours (Foldes et al. 2010). More so, there is a lack of focus on young adulthood as this age group is considered the "missing link" between youth prevention and adult cessation (Rath et al. 2012). We address this research gap by examining the extent to which young adults who have progressed from adolescents are likely to vape in the future as a consequence of being exposed to e-cigarette advertising. Participants were briefly introduced to the questionnaire administration procedure and the objective of the study. The researchers handed out the questionnaires to participants and sought their consent to complete.
The questionnaire was designed to examine attitude-relevant responses and normative beliefs towards e-cigarettes use and awareness of e-cigarette promotional messages. Participants answered questions on demographics (age and sex) and smoking status. Overall 960 participants comprising 436 wave one and 524 wave two participants responded to the surveys. This study used only former- and never-smokers consisting of 382 wave one and 494 wave two participants (Table 1). Never smokers are those who have not smoked in their lifetime, and former smokers are those who have smoked at least 100 cigarettes in their lifetime but had

stopped smoking at the time of the interview. Ethical approval was granted before the study was conducted by the Ethics and Review Board of Nottingham Trent University.

Insert table 1 here

Measures

Awareness of e-cigarettes promotional messages: Participants were asked to report whether they have seen, heard, or read a message about e-cigarette promotions or information from the following media sources (e.g. on television, magazines, newspapers, in stores) in the past 30 days. The question asked was: "Which of the following sources have you ever seen, heard, or read about e-cigarettes promotion (on television, in magazines, newspapers, in stores and gas stations, news story on television, news story in newspapers, and online)?" with response options "yes" and "no." This study used only salience of e-cigarette advertising in stores and gas stations because about two-thirds of participants reported seeing e-cigarettes depictions in stores and gas stations, with around a tenth noticing from other media sources. We did not use the reported proportions of the other media sources because it was not possible to perform meaningful statistical analysis.

Cognitive attitudes: Crites et al.'s (1994) study was used as a guide to construct the measures of cognitive attitudes. Participants were asked: Thinking about e-cigarettes in general, how strongly would you disagree or agree with the following? (1) I think that using e-cigarettes could cause serious health problems, (2) I think that electronic cigarettes are less harmful than regular cigarettes, and (3) I think that e-cigarettes can be used as an aid to stop smoking.

Affective attitudes: Affect measures were constructed based on Rash and Copeland's (2008) study. Four adjectives were developed to describe negative affective states. Participants were asked: Imagine the different kinds of emotional responses that people may feel about electronic cigarettes. In thinking about using e-cigarettes, how strongly does this thought make you feel: (1) Nervous, (2) Unpleasant, (3) Fearful, and (4) Worried. For each adjective, participants were asked to select from the response options (5) Not at all, (4) Weakly, (3) Somewhat, (2) Strongly, or (1) Very strongly.

Conative (behaviour intention): Two items assessed willingness or intention to vape in the future, with each item rated (1=definitely yes to 4=definitely not). The questions asked were: "Do you think you will try e-cigarette in the next three months?" and "Do you think you will use e-cigarette in the next year."

Subjective norms (SN): Three items were developed from Finlay et al.'s (1997) study to measure SN on a 5-point scale (1 = strongly disagree, 2 = disagree, 3 = neither disagree nor agree, 4 = agree, and 5 = strongly agree). These are: "Most people whose opinions I value would approve of me vaping", "Most people like me would vape because it is less harmful than regular cigarettes", and "Most people like me would vape because they do not want to smoke regular cigarettes."

Statistical Analyses

To test the hypotheses, statistical analyses were performed with AMOS (version 24) and IBM SPSS (version 24). Smoking prevalence rates were computed to examine the extent to which the sample varied by smoking status and demographic variables (Table 1). Correlation analyses examined associations between the variables of interest as shown in table 2. Reliability analyses were conducted to show the internal consistency of the items used, which revealed

Cronbach's alpha of 0.61 or more for all the scales tested. Convergent and discriminant validity tests were also performed, which met the acceptable criteria (CR > .07, and AVE > .05). Bayesian structural equation modelling (SEM) (see figure 1) examined the direct and indirect relationships between salience of e-cigarettes promotional messages, attitude relevant variables, subjective norms and intention to vape. Further tests were performed to examine whether subjective norms moderated cognitive and affective responses on intentions to vape. Finally, we examined whether there were variations by smoking status, gender and age.

Insert table 2 here

Bayesian SEM

This study used Bayesian method which utilises prior beliefs about how a parameter is distributed in a population. Bayesian method is not based on sampling distributions and therefore has the potential to produce reliable estimates for small-sized samples (Ansari & Jedidi 2000, Yuan & MacKinnon 2009). This approach is useful in performing structural equation modeling which has a mixture of discrete and continuous variables, nonlinear variables (Arminger & Muthén 1998), SEM with missing data (Song & Lee 2002), and semi parametric SEMs (Guo et al. 2012). During Bayesian analysis, prior beliefs are combined with new data to obtain a new distribution – i.e., a posterior distribution. The posterior predictive p-value (PPP) is used to evaluate the fit of the model. It examines how well the data generated fits with the observed data (Gelman et al. 2004). According to Muthen and Asparouhov (2012), a PPP value around .50 indicates that the model is an excellent fit. In Bayesian SEM, model parameters are evaluated using credible intervals.

A credible interval is the probability that a parameter lies within a particular interval (Arbuckle 2013). A 95% credible interval (CI) suggests that the parameter value lies within the interval with the probability of 0.95 (Kaplan 2014). The means of the posterior distribution are considered as the parameter estimates and the standard deviations are akin to the standard errors obtained from ML estimation (Arbuckle 2013). Markov chain Monte Carlo (MCMC) algorithm is used to ensure convergence of parameter estimates (Kruschke 2014). A measure of model convergence is the convergence statistics (CS), with CS values less than 1.002 considered as an indication of model convergence.

CFA using Bayesian estimation

Prior to the Bayesian analyses for this study, all binary variables (i.e. awareness of e-cigarettes promotional messages) were converted to ordered categorical variables. During the CFA analysis, AMOS generated and discarded default samples of 500 as burn-in samples, before drawing the first sample and holding that in the analysis. The 500 samples were deemed enough to bring about convergence in the posterior distribution**.** Convergence was achieved for the CFA analysis in less than 1 minute. The convergence statistics was less than 1.002 which suggested that the posterior values of hypothesised paths of CFA are precise (Gelman et al. 2004). As expected MCMC algorithms provided posterior means of regression weights that fell within the 95% credible intervals (i.e. the lower and upper bound of 95% credibility interval did not include zero), with standard deviations for all paths (Arbuckle 2013).

Bayesian SEM Analysis

Bayesian mediation analysis was performed based on the guidelines given by Rungtusanatham et al. (2014). Results of the Bayesian SEM analysis produced posterior means, standard deviations, and credible intervals for all hypothesized paths (Table 3). Convergence was achieved as the CS value was around 1.001. The structural paths in the model that were statistically significant had 95% credibility interval range values that did not include zero,

which indicated support for the hypothesized relationships. The posterior predictive p-value was 0.49 which indicates a good model fit.

Insert table 3 here

Results

Preliminary findings revealed comparable smoking prevalence for waves one and wave two survey data by gender (Table 1). Around two-thirds of former smokers in waves one and two surveys were males whereas about half of never smokers in waves one and two were females aged 18-24 years. Correlation analysis depicted several significant associations between normative and attitudinal variables of interest (Table 2). Results from wave one survey showed that there were positive correlations between awareness of advertising messages and affective attitudes among former- and never-smokers, and both relationships were statistically significant with p-values (P<.01 and P<.05) respectively. Similarly, statistically positive correlations between awareness of advertising messages and cognitive responses were observed among former smokers and never smokers (with p-values <.05) for both associations. Affective attitudes were statistically positively correlated with cognitive attitudes among former smokers and never smokers (p-values for both were <.01). Additionally, cognitive attitudes were statistically positively associated with intention to vape among former- and never-smokers (with p-values P<.01 and P<.05) respectively. For all the above correlations, the strength of the associations was stronger among former smokers compared to never smokers.

Correlation analysis from wave two survey data depicted that affect was significantly positively correlated with cognitive responses as well as subjective norms among former- and never-smokers (with p-values <.05 or better). Of interest is the fact that the strength of the correlations was stronger among former smokers than never smokers. Likewise, awareness of advertising messages was positively correlated with affective responses ($p < .01$), cognitive attitudes ($p < .05$), subjective norm ($p < .05$) and intention to vape ($p < .01$) among former smokers. Among never smokers, there was a statistically significant positive association between awareness of advertising messages and affect and cognitive responses with p-values <.05 for both associations. Also, cognitive responses were statistically positively correlated with intention to vape among former- and never-smokers (p-values <.05 for both correlations). Notably, the correlations in wave two were stronger and highly significant than the ones observed in wave one.

Bayesian SEM results from wave one indicated that salience of e-cigarettes advertising significantly affected cognitive attitudes (B= .35, 95% CI: .11 - .51), affective attitudes (B= .20, 95% CI: .19 - .58), and subjective norms (B= .22, 95% CI: .11 - .43) among former smokers (Table 3). Similarly, significant paths were found among never smokers as salience of e-cigarettes advertising directly affected cognitive attitudes (B= .20, 95% CI: .01 - .51) and subjective norms (B= .20, 95% CI: .13 - .56). Former smokers' intentions to use e-cigarettes were directly affected by affective responses (B= .49, 95% CI: .38 - .62) and subjective norms (B= .50, 95% CI: .30 - .70), with acceptable 95% credibility interval. However, for never smokers only the path from cognitive responses to intentions to vape was significant (B= .20, 95% CI: .10 - .40) although subjective norms moderated with cognitive attitudes to predict vaping intentions (B= .24, 95% CI: .11 - .54). We found that subjective norms also moderated the effect of affective responses on vaping intentions among former smokers (B= .23, 95% CI: .17 - .34).

Bayesian results for wave two SEM analysis revealed that among former smokers, awareness of advertising messages significantly affected cognitive attitudes (B= .64, 95% CI: .50 - .91), affective attitudes (B= .30, 95% CI: .09 - .50), and subjective norms (B= .31, 95% CI: .12 -

.60). Also, former smokers' intention to vape was predicted by affect (B= .50, 95% CI: .28 - .62) and subjective norms (B= .61, 95% CI: .43 - .90), and their affective attitudes interacted with subjective norms to impact intentions to consume e-cigarettes (B= .40, 95% CI: .16 - .75). For never smokers, the paths from salience of e-cigarette advertising message significantly affected cognitive responses (B= .57, 95% CI: .32 - .90) and subjective norms (B= .20, 95% CI: .11 - .40). More so, never smokers' vaping intention was predicted by cognitive attitudes (B= .40, 95% CI: .23 - .60) and affect (B= .30, 95% CI: .10 - .60), whilst subjective norms interacted with cognitive attitudes to impact intentions to vape (B= .30, 95% CI: .17 - .44).
Multigroup test was also performed to assess whether there were differences by gender and smoking status for each wave, which resulted in no variation by gender. However, in wave one, smoking status moderated the association between salience of promotional messages and cognitive attitudes towards vaping as the effect was higher among former smokers compared to never smokers. Former smokers in wave two were more likely to hold stronger affective attitudes than never smokers and these led to more favourable intentions to vape in future among former smokers. There was no variation between the paths from subjective norms to intentions to vape by smoking status, but the paths from awareness of promotional messages to cognitive responses and subjective norms were significantly different by smoking status (i.e. former smokers had stronger cognitive attitudes and subjective norms as a result of being exposed to e-cigarette promotional messages than never smokers).

Discussions

Empirical data has shown that attitude-relevant responses to tobacco portrayals can affect e-cigarettes consumption (Chan et al. 2018; Popova et al. 2018; Dockrell et al. 2013). However, knowledge of how attitudinal components (cognitive and affective) and normative responses toward e-cigarettes advertising may inform intentions to vape is limited. This study draws from the hierarchy of effects model (Lavidge & Steiner 1961) and theory of reasoned action (Fishbein & Ajzen 1975) to examine whether former- and never-smokers' cognitive, affective and normative responses to advertising messages might predict their intentions to vape. Preliminary results showed that majority of the respondents were never smokers in both waves. E-cigarette depictions were highly noticeable in stores and gas stations as indicated by approximately two-thirds of former- and never-smokers. Our findings resonate with evidence which showed a surge in awareness of e-cigarette advertising among young people in retail locations (Truth Initiative 2015; Pokhrel et al. 2015). It is possible that the substantial availability of e-cigarettes in retail outlets (Eadie et al. 2015) may have contributed to the high level of awareness of e-cigarettes advertising among participants.
Likewise, the present study demonstrates how visual depictions of e-cigarettes in stores can shape emotions, cognitions and norms of vaping. Salience of advertising messages on vaping intentions via affective attitudes in wave two was higher among former smokers than their counterparts in wave one. Our data suggests that if stronger affective attitudes are activated among former smokers, perhaps because of increased favourability of advertising messages (Yang et al. 2018) then they might be inclined to consider vaping. Although vaping is not completely safe, former smokers are better off if they develop positive intention to vape rather than consider smoking. However, if they start and continue vaping over a long period, then they might relapse though some evidence suggest that this might not happen (Dave et al. 2019; Kim et al. 2015). The results showing the mediational role of affective attitudes on salience of e-cigarette advertising and vaping intention is in line with research that demonstrated the affective mechanisms through which visuals become persuasive (Dixon 2016; Powell et al. 2015; Yang et al. 2018).
Consistent with prior research (Yang et al. 2018), results from waves one and two surveys also revealed that awareness of e-cigarette advertising in retail outlets significantly predicted never

smokers' cognitive attitudes, which in turn affected intention to vape. The results are worrying because never smokers who develop stronger cognitive attitudes towards vaping perhaps because of greater exposure to e-cigarette advertising might decide to start vaping and consider experimenting cigarette smoking and become long-term daily cigarette smokers. Therefore, although e-cigarettes might provide a lower level of risks than traditional cigarettes for smokers, efforts are required to discourage never smokers from taking up the habit.

We found that salience of e-cigarette advertising in retail outlets was associated with subjective norms, and this, in turn, affected intentions to vape among former smokers. Essentially, the effect of the hypothesised paths on intentions to vape was stronger among former smokers in wave two than those in wave one. The findings suggest that awareness of advertising stimuli may reinforce former smokers' beliefs about significant referents' vaping norms (Voigt 2015), which may motivate them to consider vaping. The results also show that subjective norms interacted with affect to predict intention to vape among former smokers in waves one and two. As such beliefs about significant others' vaping norms might strengthen positive emotions of former smokers who may decide to vape (Chan et al. 2018; Caponnetto et al. 2013). Likewise, findings from waves one and two showed that never-smokers are strengthened cognitively by subjective norms to predict intention to vape, which suggest that beliefs of referent others about vaping can support favourable thoughts of vaping.

A multi-group test to assess differences by smoking status found that former smokers in wave two survey were more likely to hold stronger affect than never smokers and these attitudes led to more favourable intentions to vape. This result supports initial findings which revealed that once favourable emotions are triggered among former smokers, this can affect vaping intentions. Likewise, wave two data showed that the paths from awareness of advertising messages to cognitive responses and subjective norms were stronger among former smokers than never smokers. Though the results suggest a greater effect of ad message on former smokers' cognitive attitudes and normative perceptions, the association of cognitive and normative responses with intention to vape was comparable by smoking status. Further work is needed to understand whether such variations by smoking status exist in the relationship, which may affect vaping intention in the long term.

Implications for policy and theory

The present study has important theoretical and policy implications. To the best of our knowledge this is the first study that provides empirical evidence to support the mediational effects of cognitive and affective attitudes, and moderation of normative perceptions. Majority of prior studies have overlooked the multidimensional role of attitudinal and normative components in determining vaping intentions. On one hand, the mediation results showing stronger cognitive attitudes reported by never smokers may represent favourable evaluations of the advertising stimuli that promote the benefits of e-cigarettes. Such attitudinal responses triggered positive intentions to vape in the future. On the other hand, former smokers who demonstrated stronger affective responses towards the advertising stimuli revealed the strength of the ad message to trigger their underlying motivations to consider vaping in the future.

Given that advertising in retail outlets communicated favourably to former- and never-smokers by shaping their attitudinal responses, efforts should be aimed at reducing the impact of such portrayals in stores. One may argue that former smokers are better off vaping than smoking although never smokers might not consider vaping if there were no depictions of e-cigarettes. However, the challenge is that former- and never-smokers who begin to vape might end up smoking regular cigarettes. Emerging evidence suggests that e-cigarette advertising may not encourage smoking (Nagelhout et al. 2016; Dave et al. 2019), but this is not enough to permit the marketing of e-cigarettes without regulations.

Regulators should therefore introduce restrictions on all forms of electronic cigarettes depictions in stores. The present advertising legislation in the UK does not include restrictions on some forms of e-cigarette advertising such as outdoor and point-of-sale advertising (Department of Health 2016; Action on Smoking and Health 2019). As one would expect, the industry has exploited this loophole to increase e-cigarette depictions in retail outlets (Eadie et al. 2015; Wan et al. 2017). Hence, all forms of portrayals that glamorises use of electronic cigarettes in retail outlets should be prohibited. Likewise, since advertising of e-cigarette at point-of-sale appears to communicate the benefits of vaping to both former- and never-smokers, regulators should restrict use of misleading information such as cessation aids on e-cigarette brands. A policy that requires warning labels to be attached to e-cigarette products may increase awareness of the potential risk of vaping among users and non-users. Such efforts will also balance the current supportive messages about e-cigarettes which are available in the media.

Another important contribution is the findings that subjective norms moderated the paths from affective and cognitive responses to vaping intentions among former- and never-smokers respectively. The results reveal the strength of normative perceptions to shape affective attitudes of former smokers and cognitive attitudes of never smokers to think positively about vaping in the future. This finding is worrying because it might lead to renormalisation of smoking although some evidence suggest that this might not be the case (Dave et al. 2019; Kim et al. 2015). As such appropriate measures are required to discourage vaping norms. Future research that uses the traditional antecedents (i.e. subjective norms and attitudes) as predictors of pro-social behaviours will also benefit from including all three attitudinal and normative components.

Implications for practice

The current research also offers implications for practice, which are crucial for designing distinct interventions aimed at former- and never-smokers, especially as a report by the Public Health England on e-cigarettes is inconclusive (Public Health England 2016). Among former smokers, affective (rather than cognitive attitudes) and normative beliefs mediated the relationship between salience of e-cigarette advertising and intentions to vape. As such interventions that are aimed at discouraging electronic cigarettes use among these groups should incorporate messages that invoke negative feelings and emotions about electronic cigarettes. For instance, advertising messages that connect electronic cigarettes with the potential risk of vaping will help former smokers to develop stronger negative associations with the product. Such emotional advertising messages should be integrated with normative or re-educative messages to show that people who are important to them do not approve of vaping. Incorporating both emotional and re-educative messages into advertising can lead to powerful negative emotions and denomalise vaping.

In the same vein, the mediational role of cognitive attitudes on e-cigarette advertising awareness and vaping intentions among never smokers suggests that cognitive messages that present rational arguments or pieces of information to them should be integrated into smoking cessation interventions. The use of a cognitive message strategy that focuses on the attributes of the product will assist in rational evaluation of the potential consequences of using the product. Although the advertising message exposure was not related to never smokers' affective attitudes, their affect was associated with vaping intentions. Therefore, including messages that invoke negative feelings of vaping might strengthen their cognitive attitudes

towards vaping. More importantly, as norms interacted with cognitions, interventions that combine cognitive, affective and normative disapproval messages may shape attitudes and reinforce denormalization of vaping.

Conclusions

Presently, the UK public health community has indicated that e-cigarettes are safer than conventional cigarettes and that electronic cigarettes can play a significant role in smoking cessation. However, scientific evidence to support the health risks and benefits of e-cigarettes is limited. More longitudinal and experimental studies are needed to inform health advocates and policymakers of the long-term effects of vaping, and the mechanisms underlying e-cigarettes consumption in order to develop effective interventions. The challenge is that e-cigarette products are promoted to former smokers and never smoking youths who would not otherwise have smoked, as vaping holds no benefit whatsoever for these groups. So, e-cigarette regulation is needed to support smokers who find it difficult to quit to switch to less harmful nicotine products like e-cigarettes. Nonetheless, such a policy intervention should be carefully considered so that it does not trigger use among former smokers, never smoking youths and young adults. As the WHO (2017) report indicated, regulations are needed to obstruct e-cigarette promotion to non-smokers and young people.

Limitations and future research

Our study has some limitations. First, the samples used in this study were obtained from cross-sectional surveys. As such all data are correlational and, therefore, causality cannot be inferred. Future research should use cohort data to investigate attitudinal and normative mechanisms underlying e-cigarette advertising exposure and the long-term effects of vaping. Second, a non-probability sampling technique was used to recruit participants via a convenience sampling procedure. As such the results may not be representative of the target population. Howbeit, although use of Bayesian methods allowed small samples to produce reliable estimates, future research should use probability sampling procedure to test the external validity of results with similar samples from the population. Lastly, use of self-report smoking behaviour may be under-reported or over-reported if participants merely agree with the question asked. However, most studies have used self-reported procedure to determine status with efficient estimates. More so, in the UK, there are partial restrictions on e-cigarettes marketing which allows advertising at point-of-sale and outdoors (Department of Health and Social Care 2016; Action on Smoking and Health 2019). Therefore, it is possible that levels of attitudinal and normative influences towards vaping may be higher than reported in this study. Future research may examine the impact of e-cigarette advertising and promotion bans on attitudes and norms of vaping.

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Figure 1: Hypothesised model of attitudinal and normative responses to e-cigarettes promotional stimuli and intentions to vape (among former- and never-smokers)

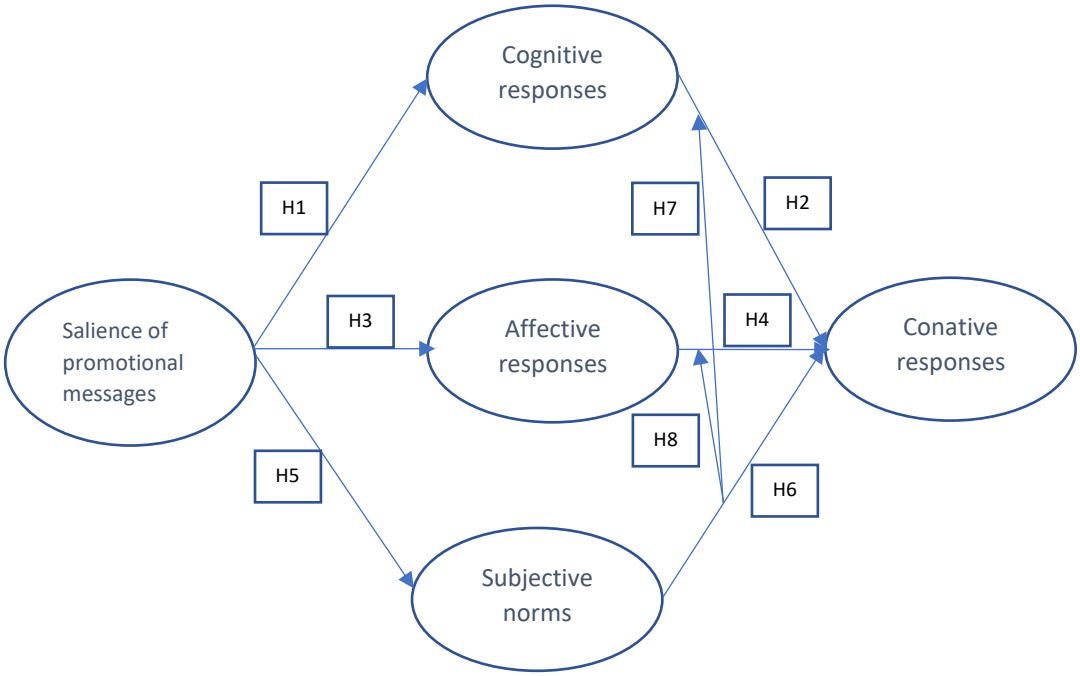

Table 1 Sample characteristics of smoking status by demographics

Sample characteristics	Wave 1		Wave 2	
	Former smokers	**Never smokers**	**Former smokers**	**Never smokers**
	104	278	197	297
Age group (%)				
18	23.1	28.3	20.3	26.5
19	29.8	33.7)	29.2	32.2
20	25.0	20.3	25.7	18.6
21	18.3	10.5	19.3	11.7
22	1.0	4.3	2.5	8.2
23	1.0	2.9	1.0	2.8
24	1.8	0	2.0	0
Gender (%)				
Males	66.3	45.7	65.5	44.4
Females	33.7	54.3	34.5	49.0

Table 2 Bivariate correlation of smoking norms and attitude relevant responses toward smoking

Wave 1	Former Smokers					Never Smokers				
	Awareness	**Affect**	**Cognitive**	**Subjective**	**Intent**	**Awareness**	**Affect**	**Cognitive**	**Subjective**	**Intent**
Awareness	1					1				
Affect	.40**	1				.30*	1			
Cognitive	.31*	.49**	1			.21*	.27**	1		
Subjective	.17	.34*	.11	1		.10	.23**	.05	1	
Intent	.47***	.08	.42**	.10	1	.09	.03	.13*	.04	1

Wave 2	Former Smokers					Never Smokers				
	Awareness	**Affect**	**Cognitive**	**Subjective**	**Intent**	**Awareness**	**Affect**	**Cognitive**	**Subjective**	**Intent**
Awareness	1					1				
Affect	.37**	1				.33*	1			
Cognitive	.40*	.58***	1			.27*	.31**	1		
Subjective	.21*	.36**	.23*	1		.05	.29*	.23*	1	
Intent	.68**	.28*	.19*	.05	1	.10	.03	.14*	.02	1

*p < 0.05; ** p < 0.01; *** p < 0.001

Table 3 Results of Bayesian SEM Analysis

Wave 1								
	Former smokers				Never smokers			
Paths	Regression weights	SD	95% Lower bound	95% Upper bound	Regression weights	SD	95% Lower bound	95% Upper bound
AOEP → CR	.35	.03	.11	.51	.20	.02	.01	.51
AOEP → AR	.20	.09	.19	.58	-04	.03	-.06	.01
AOEP → SN	.22	.06	.11	.43	.20	.02	.13	.56
CR → ITV	-.02	.04	-.03	.07	.20	.04	.10	.40
AR → ITV	.49	.02	.38	.62	-.01	.03	-.05	.10
SN → ITV	.50	.02	.30	.70	-.03	.02	-.11	.02
CR x SN → ITV	.01	.03	-.07	.02	.24	.05	.11	.54
AR x SN → ITV	.23	.05	.17	.34	-.02	.03	-.16	.26
Wave 2								
	Former smokers				**Never smokers**			
AOEP → CR	.64	.02	.50	.91	.57	.04	.32	.90
AOEP → AR	.30	.05	.09	.50	-03	.02	-.04	.03
AOEP → SN	.31	.04	.12	.60	.20	.02	.11	.40
CR → ITV	-.01	.09	-.02	.05	.40	.03	.23	.60
AR → ITV	.50	.02	.28	.62	.30	.03	.10	.60
SN → ITV	.61	.01	.43	.90	-.07	.04	-.08	.04
CR x SN → ITV	.01	.03	-.02	.09	.30	.02	.17	.44
AR x SN → ITV	.40	.01	.16	.75	.02	.01	-.03	.07

AOEP Awareness of e-cigs promotion; CR Cognitive responses; AR Affective responses; SN Subjective norms; ITV Intention to vape